

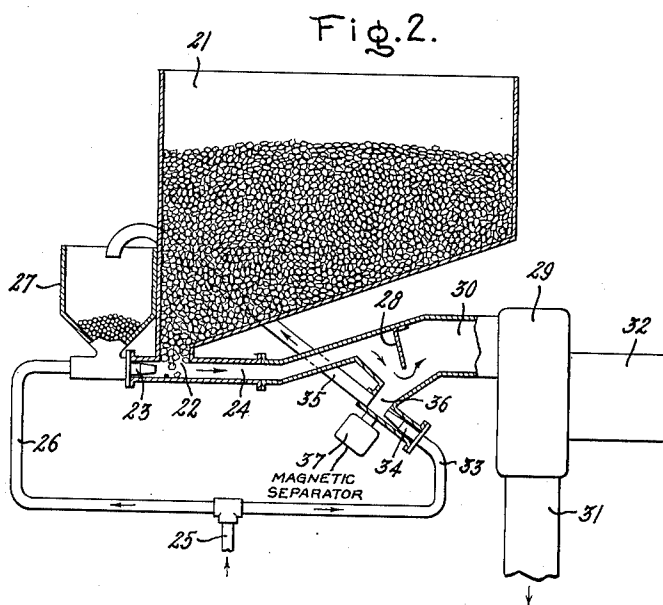
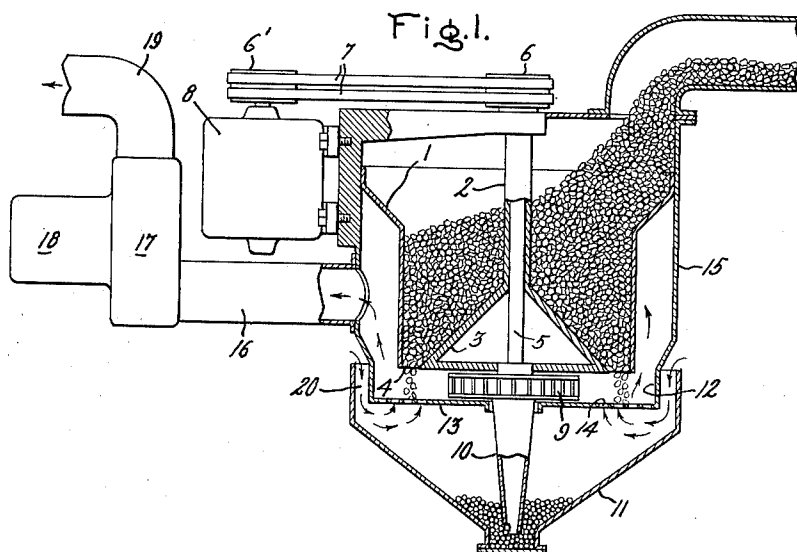
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R. G. ANDERSON

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FLUID PULVERIZING APPARATUS

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Inventor:
Robert G. Anderson,
by *Perrell S. Mack*
His Attorney.

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FLUID PULVERIZING APPARATUS

Robert G. Anderson, Erie, Pa., assignor to General Electric Company, a corporation of New York

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My invention relates to pulverizing apparatus, and more particularly to an improved type of pulverizing machine for quickly and efficiently reducing to a powdered state materials such as coal.

There is a present trend in the locomotive and railway art towards the more economical production of motive power from solid and liquid fuels, and one phase which is becoming of interest is the use of powdered coal as a locomotive fuel. It has the advantage that it may be utilized either in the conventional reciprocating or steam turbine locomotives, or it may be burned directly in a gas turbine, thereby producing locomotive driving power. In order for powdered fuel to be advantageously used, it is necessary that compact, lightweight and highly efficient apparatus for pulverizing or powdering the coal be carried as a part of the locomotive due to the difficulties in handling this material. It is not feasible to transport the coal in powdered state due to its inflammable nature and to the difficulties in handling it in the powdered state. It is, therefore, advisable to carry the bulk coal on the locomotive tender in small size pieces and provide pulverizing apparatus directly connected with the firebox or fuel-consuming device so that a minimum of handling of the powdered fuel is required.

It is an object of my invention to provide an improved form of pulverizing apparatus.

It is a further object of my invention to provide pulverizing apparatus in which metallic particles are employed as pulverizing agents.

It is another object of my invention to provide an improved pulverizing apparatus in which the material to be treated is powdered to a fine state by being subjected to the breaking and crushing action of metallic particles having a high velocity.

My invention will be more clearly understood by reference to the accompanying drawing, in which Fig. 1 illustrates a form of pulverizing apparatus in which the material, coal for example, is pulverized by action of metallic particles thrown from a rotary impeller at high velocity against the coal, and in Fig. 2 a modification of my invention is shown in which the metallic particles are propelled against the coal to be pulverized by a stream of high pressure air, thus forcing the metallic shot and the coal particles against an anvil for crushing the coal.

Referring now to Fig. 1, I have shown a cylindrical hopper or casing 1 adapted to hold the material to be pulverized and having a central shaft-supporting column 2 with a flared conical lower portion 3, thereby providing a funnel or a maga-

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zine-shaped feeding mechanism and allowing the coal to be pulverized to flow through the annular aperture 4 at the base of the hopper 1. Supported in bearings within the column 2 is a shaft 5 arranged for high speed rotation by the pulleys 6 and 6', belts 7 and driving motor 8, and carrying at its lower end positioned immediately beneath the hopper a rotary impeller 9 of the vane type. Connected to the central aperture in the impeller 9 and extending downwardly therefrom is a feeding mechanism 10 for elevating metallic particles such as steel grit or shot from the collecting bin 11 up into the rotary impeller. For raising the metallic particles I have shown the elevator 10 as having a conical configuration with an opening at the bottom end which will extend into the supply of metallic shot. Due to the upwardly tapered conical configuration, under high velocities of rotation the shot will be elevated upwardly in the conveyor due to the action of centrifugal force. If it is found in practice that insufficient shot is raised in this manner the interior of the elevator 10 may be formed with a spiral thread in the same manner as the well known screw-type conveyor which will insure that an adequate supply of pulverizing shot reaches the central portion of the impeller 9.

As the shot is thrown outwardly by the impeller 9, it will strike the ring-shaped anvil or striking surface 12 surrounding the impeller 9. As the coal flows through the annular aperture 4 in a cylindrical curtain-like shape, it is struck by the metallic shot thrown outwardly from the impeller and crushed against the anvil 12, thereby being pulverized and reduced to a finely powdered state. The shot after striking the anvil 12 and giving up its energy falls to the plate 13 which is provided with a plurality of openings 14, as shown, and is thereby returned to the collecting bin 11 for the metallic particles. A suction blower system is provided for withdrawing the powdered coal from the pulverizing chamber and, as shown, includes the outer casing 15 of the hopper which forms an annular chamber above the pulverizing anvil 12 and which is connected to the intake duct 16 of a rotary blower 17 arranged to be driven by the motor 18. The discharge duct 19 may then be connected to the powdered fuel burning apparatus or may be connected to a storage means in the event immediate use of the powdered material is not required. The directions of the arrows in Fig. 1 illustrate the flow of air through the apparatus when the blower 17 is operating. From this it can be seen that the air flow enters downwardly through the annular space 20 surrounding the

anvil 12 and passes upwardly through the apertures 14 in the base plate 13, thereby preventing the powdered material from sifting downwardly into the metallic shot storage bin or from escaping to the outside where it would form a fire hazard. The powdered material thus trapped in the air stream flows upwardly into the annular jacket surrounding the hopper and thence into the intake duct 16 and out through the blower and outlet duct 19. The velocity of air flow through the pulverizer may be adjusted so that only particles of a required small size will be trapped in the air stream and carried through the blower, in which case those particles which have not been sufficiently pulverized will fall through the perforations 14 into the metallic shot storage bin and will be again elevated into the impeller 9 and again subjected to the pulverizing process. Since there will be an inherent tendency of the impeller 9 to act as a blower, a suction will be created in the cone elevator 10 thereby assisting in raising the metallic shot and any pieces of unpulverized material which may have sifted through the perforations 14.

It is believed that the operation of the device shown in Fig. 1 will be understood from the foregoing description, and that it will be observed that a highly efficient pulverizing action takes place as the metallic shot is thrown, at high speed, against the curtain of material to be pulverized as it flows downwardly from the bin 1 through the annular orifice 4. Any pieces which are too large to sift through the perforations 14 will remain in the pulverizing area and be driven against the anvil 12 by the shot, thereby insuring that all the material is satisfactorily treated.

In Fig. 2 I have shown a modification of the pulverizing apparatus in which metallic shot entrained in a stream of high pressure air is blown against the material to be pulverized, and the entire mass is carried against an anvil or striking surface whereby the material is shattered and finely powdered. Fig. 2 comprises a hopper or magazine 21, arranged to hold the material to be pulverized, and having an outlet 22 directly in line with an air nozzle 23 which is located centrally in the high pressure air duct 24. High pressure air is supplied to the pulverizer through the inlet pipe 25 and through the piping 26 to the nozzle 23. A second hopper or magazine 27 for feeding the metallic particles or shot into the air stream is located above the inlet side of the nozzle 23, and the metallic particles are fed by gravity into the air stream and then projected through the nozzle and against the material to be pulverized as it flows through the aperture 22 in the storage bin 21. The stream of high pressure air with the metallic shot and coal particles entrained therein is forced at high velocity against the striking plate or anvil 28, and the coal or other material to be pulverized is finely powdered by action of the bombardment of the metallic particles as well as the shattering action resulting from striking the anvil 28 at high velocity. The finely powdered material resulting from the pulverizing process is withdrawn by a suction blower 29 having its inlet duct 30 directly connected to the pulverizing chamber. The outlet duct 31 may then be connected to the powdered fuel burner or to suitable storage means as previously mentioned in connection with Fig. 1. Any suitable form of drive motor 32 may be used to drive the blower 29. I have also provided means for returning the metallic particles to the magazine 27 which may be done by high pressure air

also supplied from the air inlet 25. As shown in Fig. 2, the high pressure air is supplied through the pipe 33 to a nozzle 34 mounted in axial alignment with the conveyor pipe 35 which terminates at its upper end into the shot storage bin 27. Thus, as the metallic shot loses its energy in striking the anvil 28, it falls by gravity into the space 36 in line with the high pressure nozzle 34, and is propelled by the high pressure air through the discharge pipe 35 and back into the shot storage bin. Inasmuch as the weight of the shot is too great for it to be carried along with the powdered material by the blower 29, separation of the powdered material and shot is easily obtained. However, if difficulty is encountered by occasional shot being carried into the blower 29 through the inlet duct 30, a conventional magnetic separator, shown generally at 37, may be provided which will insure that the metallic shot, which normally will be made of magnetic material, will be directed into the space 36 where it will be trapped in the high pressure air stream and returned to the magazine 27. In the event any of the particles to be pulverized are not sufficiently powdered to be carried into the blower, they will fall into the space 36 and be returned along with the metallic particles to the storage bin 27. Thus, they will be again subjected to the breaking and powdering action as they are blown through the nozzle with the metallic particles against the anvil 28, thereby assuring that complete pulverization is obtained.

While I have discussed the operation of my invention with particular reference to the pulverizing of coal, it will be understood that the apparatus lends itself to the powdering or size reduction of any other suitable material, such as gypsum, cement or other mineral or food substances. The apparatus shown and described is advantageous in that it may be made in relatively compact form and operates very efficiently, thereby lending itself to portable use or use on a traction vehicle such as a coal burning locomotive. By choice of the size of shot provided and adjustment of the air flow for removing the powdered material, the resultant size of the powdered particles may be varied to suit the particular application for which the pulverizer is used.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from my invention in its border aspects, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Pulverizing apparatus for solid materials comprising in combination, an elongated tubular pulverizing chamber, an anvil surface disposed at one end of said chamber, a high pressure air nozzle positioned at the opposite end of said chamber in alignment with said anvil surface, means for supplying metallic shot to said air nozzle whereby said shot will be projected at high velocity through said chamber and against said anvil surface, means adjacent said air nozzle and communicating with said chamber for introducing material to be treated into said high velocity stream whereby said material is struck by said metallic shot and crushed against said anvil surface, collecting means for said metallic shot including a magnetic separator disposed

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beneath said anvil surface, and suction blower means for withdrawing said pulverized material from said chamber.

2. Pulverizing apparatus for solid materials comprising in combination, an elongated tubular pulverizing chamber, an anvil surface disposed at one end of said chamber, a high pressure air nozzle positioned at the opposite end of said chamber in alignment with said anvil surface, means for supplying metallic shot to said air nozzle whereby said shot will be projected at high velocity through said chamber and against said anvil surface, means adjacent said air nozzle and communicating with said chamber for introducing material to be treated into said high velocity stream whereby said material is struck by said metallic shot and crushed against said anvil surface, a suction blower for withdrawing said pulverized material from said chamber, shot collecting means disposed beneath said anvil surface, and air pressure operated means positioned within said collecting means for return-

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ing said metallic shot to said shot supplying means.

ROBERT G. ANDERSON.

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